

U. S. DEPARTMENT OF AGRICULTURE,

BUREAU OF SOILS—MILTON WHITNEY, Chief.

IN COOPERATION WITH THE WEST VIRGINIA GEOLOGICAL SURVEY,
I. C. WHITE, STATE GEOLOGIST.

SOIL SURVEY OF LEWIS AND GILMER COUNTIES, WEST VIRGINIA.

BY

W. J. LATIMER.

W. EDWARD HEARN, INSPECTOR, SOUTHERN DIVISION.

[Advance Sheets—Field Operations of the Bureau of Soils, 1915.]



WASHINGTON:
GOVERNMENT PRINTING OFFICE.
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LETTER OF TRANSMITTAL.

U. S. DEPARTMENT OF AGRICULTURE,
BUREAU OF SOILS,
Washington, D. C., July 21, 1916.

SIR: Under the cooperative agreement with the West Virginia Geological Survey, a soil survey of Lewis and Gilmer Counties was carried to completion during the field season of 1915.

I have the honor to transmit herewith the manuscript report and map covering this work and to recommend their publication as advance sheets of Field Operations of the Bureau of Soils for 1915, as authorized by law.

Respectfully,

MILTON WHITNEY,
Chief of Bureau.

Hon. D. F. HOUSTON,
Secretary of Agriculture.

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SOIL SURVEY OF LEWIS AND GILMER COUNTIES, WEST VIRGINIA.

By W. J. LATIMER.—Area inspected by W. EDWARD HEARN.

DESCRIPTION OF THE AREA.

Lewis and Gilmer Counties are situated in the central part of the State of West Virginia. They are bounded on the north by Ritchie, Doddridge, and Harrison Counties, on the east by Upshur County, on the south by Webster and Braxton Counties, and on the west by Calhoun County. The two counties comprise a total area of 733 square miles, or 469,120 acres. Lewis, the easterly county, has an area of 391 square miles, and Gilmer an area of 342 square miles.

Physiographically, the area lies wholly within the Appalachian Mountain and Plateau Province. The plateau which originally constituted the surface has been thoroughly dissected by stream erosion. The streams have cut narrow, V-shaped valleys and have reduced the ridges to narrow "hog-backs," leaving no remnant of the surface of the old plateau.

The surface relief in Lewis County is less bold than that in Gilmer County, owing largely to the fact that Lewis County in general represents the headwater drainage basin of the West Fork River, whereas the Little Kanawha River, which drains Gilmer County, is a well-developed stream, and its tributaries have cut down nearly to the level of the river.

For the base of the map accompanying this report, U. S. Geological Survey sheets were used. A part of these sheets show elevations in 20-foot contours, the remainder in 50-foot contours. No attempt was made to make the contour interval uniform on the soil map. That portion of the map south of the $38^{\circ} 45'$ parallel has 50-foot contours, as well as that part of the map east of the $80^{\circ} 30'$ meridian and south of the $39^{\circ} 00'$ parallel. All the remainder of the map has 20-foot contours.

In general, the surface of the area is rough and broken, the topography comprising steep slopes and low mountains. Winding ridges and numerous swells are conspicuous. These broaden out in places,

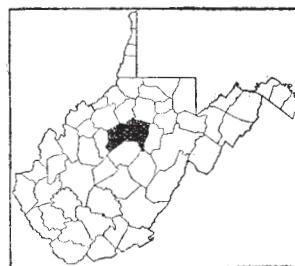


FIG. 1.—Sketch map showing location of the Lewis and Gilmer Counties area, West Virginia.

becoming somewhat flat on top, or have gentle slopes or rounded, smooth shoulders near the base. Areas of flat and level land are developed in long, narrow strips in the bottoms along the stream courses. Below Weston, along the West Fork River, the terrace development is very pronounced. This modifies the relief of Lewis County and presents a conspicuous topographic feature of the area.

The general elevation of Lewis County is 300 to 400 feet higher than that of Gilmer. The elevation of the West Fork River at Weston (near the center of Lewis County) is about 1,010 feet above sea level. That of the Little Kanawha River at Glenville (near the center of Gilmer County) is about 710 feet above sea level. The hilltops in the vicinity of these places reach elevations of about 1,500 to 1,600 feet and 1,300 to 1,400 feet, respectively. The highest part of the area is southern Lewis County, where several points reach an altitude of about 1,800 feet above sea level. The stream level rises with the general upland surface. At Ireland the Right Fork of the West Fork River flows at an altitude of 1,142 feet above sea level.

The drainage of the area is accomplished by two systems. The West Fork River and its tributaries drain all of Lewis County except a narrow strip along the western boundary and a small area in the extreme south. These parts of Lewis County and the whole of Gilmer County are drained into the Little Kanawha River, through numerous tributaries. The largest of these, Steer Creek, drains the southern part of Gilmer County. Other tributaries are Cedar Creek, in the south-central part, Leading Creek, in the northeastern part, Sand Fork, in the southeastern part, and Sinking and Tanner Creeks, in the northwestern part.

Many smaller streams and spring branches reach well back into the uplands and furnish all sections of the area with good drainage outlets. Owing to the steep topography, the run-off is rapid and drainage is excessive.

The first settlements within the area were made on Hackers Creek, in Lewis County, on land formerly occupied by Indian villages. Settlement began about 1770, and increased rapidly after the Revolutionary War, but general occupation of the counties did not take place until about 1800. The early settlers were what is known as trans-Allegheny pioneers, coming mainly from Virginia, Maryland, and Pennsylvania. A large number came from Virginia and settled upon military-grant land. The pioneers were largely of English extraction. Lewis County was formed in 1816 and Gilmer County in 1845. No conspicuous tide of immigration into the area took place until about 1850-1860, when a large number of Irish, who had been employed in the construction of the Baltimore & Ohio Railroad, settled on Sand Fork. About 1880 a colony of Germans settled on Hackers Creek in the vicinity of Berlin.

The present population consists largely of descendants of the original settlers. Many homeseekers have come in of late years from Pennsylvania and Ohio and from other counties of West Virginia, following the development of the oil and gas resources. Gilmer County has received fewer of these newcomers than Lewis, as the deposits of oil and gas have been exploited more extensively in the latter county. The population of Gilmer County is reported in the 1910 census as 11,379, and that of Lewis County as 18,281. The population of both counties is classed by the census as rural, there being no incorporated town in the area with 2,500 inhabitants.¹ The density of settlement in Gilmer County is reported as 34.4 persons to the square mile, and in Lewis County as 46.5 persons per square mile.

Glenville, the county seat of Gilmer County, had a population of 336 in 1910. One of the State normal schools is located here. Troy, Cedarville, Stumptown, and Sand Fork are small towns in Gilmer County.

Weston, the county seat of Lewis County, is the largest and most important town in the area, with a population in 1910 of 2,213. Weston is a prominent distributing point and the center of an important oil and gas district. Jane Lew, with a population of 327, is the second largest town in Lewis County. It is situated in a thriving agricultural section, as well as one in which many gas wells have been bored. Walkersville, Roanville, and Orlando are other small towns in Lewis County.

The inhabitants of the area are engaged largely in farming. In Lewis County a large number of persons are employed in the oil and gas fields and allied industries, but in Gilmer County only a few are engaged in these enterprises. Coal has never been mined on a large commercial scale, although mining to supply local requirements was carried on quite extensively until the introduction of natural gas as a fuel. Active oil and gas development began about 20 years ago, since which time progress has been rapid. The oil fields are confined to a small area, but natural gas is procurable in most parts of both counties. The gas is piped out in large quantities, and heat and light are supplied locally at very low rates.

Lumbering began in Lewis County about 1840 and was continued until about 1890. The lumbering activities consisted in part of floating logs down the West Fork and Monongahela Rivers to Pittsburgh. Much of the valuable timber in this county was cleared and burned to make way for agricultural operations. In Gilmer County logging began at a slightly later date, and continues to be one of the

¹ Weston, however, had a population in 1910 of 2,213 inside the borough limits, and about the same number outside, and it would probably be well to subtract this population from the rural population.

chief industries of the county. The logs are rafted down the Little Kanawha River to Parkersburg.

Lewis County is rather well supplied with transportation facilities, but Gilmer County is deficient in this respect. The first railroad to serve this region was the Baltimore & Ohio, built in 1854. Although this line did not touch either of the two counties, it aided in the development by giving a railroad outlet to outside points. Later a branch of the Baltimore & Ohio was built into Lewis County from Clarksburg to Weston. Two branches of this road were subsequently extended, one from Weston along Stonecoal Creek, reaching Buckhannon and Pickens, and the other passing up the valley of the West Fork River, leaving the county at Orlando and extending to Richwood. The Coal & Coke Railroad, passing through the southern part of Lewis County, touches Gilmer County at Gilmer Station on the Little Kanawha River. A narrow-gauge road extends from the main line at Gassaway in Braxton County to Rosedale, and continues as a lumber track to Stumptown, near the Calhoun County line. The Monongahela Valley Traction Co. completed an electric-line extension from Clarksburg to Weston in 1913.

The first era of development in Lewis and Gilmer Counties was marked by the building of turnpikes. The Staunton-Parkersburg Turnpike, one of the first built through the area, gave an outlet to the east and west. Other turnpikes followed and have helped to develop the various sections which they reached.

The principal markets for the area are Clarksburg, Fairmont, Parkersburg, Charleston, Pittsburgh, and Baltimore. Weston and Clarksburg furnish good local markets for produce. Live stock is shipped mainly to Baltimore, Philadelphia, and Pittsburgh.

CLIMATE.

The climate of Lewis and Gilmer Counties is mild and healthful. The winters are cold, but less rigorous than farther north and in the higher altitudes to the east. The summers are warm, but hot spells are of short duration, and the nights are generally cool.

The mean temperature for the winter is 32.4° F. A temperature as low as -29° F. has been recorded, but even zero weather is rare. The mean temperature for the summer is 72.5° F. The maximum temperature recorded is 100° F.

The average annual precipitation of 46.85 inches is well distributed throughout the year. The heaviest rainfall occurs in the spring and summer months, when most needed by the growing crops. Even in the driest year recorded (1904) the precipitation amounted to 30.25 inches. As a rule, the fall season is the driest, having a mean of 9.18 inches as against 13.80 inches, the mean for the wettest season, summer.

The annual average snowfall is 34.4 inches, of which 26.1 inches falls in December, January, and February. Snow does not remain upon the ground for long periods.

The period between the average date of the last killing frost in the spring, April 30, and the first in the fall, October 13, is approximately five and one-half months. This gives a fairly long active growing season. Killing frost, however, has occurred as late in the spring as May 29 and as early in the fall as October 1.

The climatic conditions are favorable for general farming and stock raising. The rainfall, although light in the fall, furnishes enough moisture to keep pastures green. Floods usually occur in the spring before planting time, but late August floods do considerable damage to corn in some seasons.

The following table, containing climatic data taken from the records of the Weather Bureau station at Glenville, shows the normal monthly, seasonal, and annual temperature and precipitation for the two counties. The general level of Lewis County is about 300 feet higher than that of Gilmer County and temperatures there are slightly lower, but there is no material difference in climatic conditions between the two counties.

Normal monthly, seasonal, and annual temperature and precipitation at Glenville.

Month.	Temperature.			Precipitation.			
	Mean. °F.	Absolute maximum. °F.	Absolute minimum. °F.	Mean. Inches.	Total amount for the driest year (1904). Inches.	Total amount for the wettest year (1890). Inches.	Snow, average depth. Inches.
December.....	34.8	70	-11	3.70	2.95	6.04	5.7
January.....	31.9	74	-18	3.86	2.81	4.35	9.9
February.....	30.6	76	-29	3.90	3.12	6.97	10.5
Winter.....	32.4	76	-29	11.46	8.88	17.36	26.1
March.....	44.1	86	-2	4.48	4.99	7.54	5.5
April.....	52.4	92	11	3.72	3.50	4.08	1.5
May.....	63.1	98	27	4.21	2.00	5.46	T.
Spring.....	53.2	98	-2	12.41	10.49	17.08	7.0
June.....	70.2	97	40	4.72	4.75	4.85	0
July.....	74.2	100	45	5.32	1.50	5.11	0
August.....	73.0	99	46	3.76	2.32	7.72	0
Summer.....	72.5	100	40	13.80	8.57	17.68	0
September.....	67.3	99	35	3.20	0.84	6.67	0
October.....	54.6	93	15	2.86	1.00	6.96	T.
November.....	43.2	81	10	3.12	0.47	2.89	1.3
Fall.....	55.0	99	10	9.18	2.31	16.52	1.3
Year.....	53.3	100	-29	46.85	30.25	68.64	34.4

AGRICULTURE.

The early settlers in Lewis and Gilmer Counties depended for a livelihood largely upon hunting and trapping. They made only small clearings and grew principally corn. As large game became scarce many of them moved farther west. They were supplanted by a class of settlers who enlarged the clearings and gave more attention to farming, growing corn, wheat, and vegetables. The early settlers began stock raising in a small way, grazing a few cattle and sheep in the open woods. At first the cattle were kept for milk and later, as the supply of game began to fail, for beef. The sheep were kept largely for wool.

The early farm products either were consumed on the farm or were sold to newcomers into the county or to the travelers who passed through in a continual stream on the way from the East to more westerly points. The production was barely enough to supply the demand, and it was not until emigrant travel began to lessen that cattle were driven to other markets. The Staunton and Parkersburg Turnpike, passing through the area from east to west, which was completed about 1845, was an important route to the west. The completion of the Baltimore & Ohio Railroad in 1856 diverted the main line of travel from Lewis and Gilmer Counties and changed the system of agriculture.

Although the change in transportation conditions cut off the ready markets these counties had enjoyed, it opened other markets by giving better communication with the East. Farmers began to raise cattle and sheep in larger numbers, large areas of hill land were cleared and put in permanent pasture, and stock raising became the chief form of agriculture.

Following the completion of the western branch of the Baltimore & Ohio in 1890, the farmers began to make more use of outside markets. Up to this time wheat had been grown in sufficient quantities to supply the local demands, but flour began to be shipped in from the Western States and wheat production declined rapidly. With development of the oil and gas resources, which began about 1890, farming was neglected. The farms along the terraces, which were considered the best in the county, suffered most from neglect.

According to the census, the acreage in corn in Lewis County decreased by 25 per cent during the decade from 1900 to 1910. During the same period the hay production of both counties increased. The wheat production decreased rapidly, from a total of 15,187 acres sowed in both counties in 1899 to 5,331 acres in 1909. Oats have made a slight gain in acreage since the 1880 census. Potatoes have increased steadily in acreage and yield. Buckwheat and tobacco have been grown in a small way, but are practically negligible crops at the present time.

The agriculture in Lewis and Gilmer Counties at the present time consists principally of the production of corn and hay and the raising of beef cattle, sheep and goats, hogs, and horses.

The table below shows the value of crops grown and of live stock and animal products produced in Lewis and Gilmer Counties in 1909, as reported by the Thirteenth Census:

Value of crops and live-stock products.

	Lewis County.	Gilmer County.		Lewis County.	Gilmer County.
Cereals.....	\$233,581	\$296,236	Dairy products (exclusive of home use).....	\$79,075	\$50,841
Other grains and seeds.....	1,262	895	Poultry and eggs.....	112,783	74,861
Hay and forage.....	251,042	148,398	Wool and mohair.....	23,183	11,102
Vegetables.....	149,008	124,278	Total.....	1,742,083	1,237,366
Fruits and nuts.....	88,758	59,373			
All other crops.....	34,101	88,622			
Animals sold or slaughtered.....	769,290	382,760			

The following table shows the acreage and production of the various crops in the two counties, as reported by the 1910 census:

Acreage and production of principal crops.

Crop.	Lewis County.		Gilmer County.	
	Acreage.	Production.	Acreage.	Production.
Hay.....		<i>Tons.</i> 21,250 <i>Bushels.</i>	<i>Tons.</i> 13,920 <i>Bushels.</i>	<i>Tons.</i> 11,307
Corn.....	8,781	281,275	11,547	357,198
Wheat.....	1,850	18,115	3,481	29,643
Oats.....	905	14,350	695	8,397
Potatoes.....	652	79,067	539	55,692

The leading crops, corn and hay, are grown for feeding to horses, cattle, and hogs. The cattle, together with sheep and goats, are sold and the income from this source constitutes the principal revenue of the farms. The hogs raised are used to supply pork products for home consumption and for sale at the local markets. Horses are raised as draft animals for the farm. A small proportion of the crops is sold as feed for the work stock used in the oil fields. Potatoes and other vegetables are grown in abundance for home use, and in Lewis County they are produced to some extent for the local market. Apples and peaches and various small fruits are grown in home orchards on some farms and disposed of locally, but there are no true commercial orchards in the area.

Indications are that there is more corn grown in Lewis County now than at any earlier time, and there has been a rapid increase in the number of silos. Oats, wheat, clover, cowpeas, and millet also have gained in acreage during the last few years.

The principal hay crops are timothy and clover mixed and clover alone. Of the 13,929 acres devoted to hay and forage crops in 1909 in Gilmer County mixed timothy and clover occupied 8,553 acres, timothy alone 4,229 acres, and clover alone 80 acres. In Lewis County of the 21,250 acres in all hay and forage crops timothy and clover mixed occupied 14,760 acres, timothy alone 2,737 acres, and clover alone 27 acres.

The 1910 census reports 80,916 apple trees in Gilmer County and 14,034 peach trees, 1,927 grapevines, and 19 acres of bush berries. For Lewis County there are reported 94,815 apple trees, 17,880 peach trees, 4,772 grapevines, and 234 acres of bush berries. The varieties of apples most commonly grown are the Rome Beauty, Baldwin, Ben Davis, York Imperial, Rambo, Northern Spy, Grimes Golden, Russell, Red Astrachan, Delicious, and Winesap. The fruit is of good quality and excellent color. Pears and plums are grown upon almost every farm in a small way. Raspberries are produced for market on many farms, and blackberries grow wild throughout the two counties.

Development of the live-stock industries began early in the history of the county. The 1880 census reports 21,715 head of cattle, 15,143 hogs, 22,095 sheep, and 5,630 horses and mules in the area. The 1910 census reports 14,620 head of cattle, 17,406 sheep, 4,537 hogs, and 3,645 horses and mules in Gilmer County and 20,584 cattle, 36,510 sheep, 5,243 hogs, and 5,216 horses and mules in Lewis County. The value of all domestic animals in Gilmer County is reported as \$852,384 and in Lewis County as \$1,303,798. The census reports the value of all animals sold or slaughtered on farms in Gilmer County in 1909 as \$382,760 and in Lewis County as \$769,290.

Improved Shorthorn cattle were introduced as early as 1845. The Hereford was introduced about 1875 and the Aberdeen Angus about 15 years ago. Herefords seem to be best suited to the natural conditions and animals of Hereford blood predominate at the present time. Probably half the cattle are improved stock, and there are very few scrub cattle in the area. Nearly every farmer has a pure-bred bull.

There are a large number of silos in Lewis County. The ensilage is used mainly for wintering cattle, only a few silos being operated to feed dairy stock. Before the use of the silo became general practically all the cattle fed were sold each fall and little or no attention was paid to winter cattle except those kept for breeding. A considerable number of cattle are wintered now, but the profits are not attractive, and in Gilmer County the practice of selling the cattle in

the fall is still adhered to. It is estimated that 75 per cent of the stock on hand is disposed of each season. A considerable number of cattle are bought from adjoining counties by dealers to be fattened, and nearly every farmer raises a few head, which are sold at the age of 2 or 3 years. The census reports 510 calves and 7,274 other cattle sold or slaughtered on farms in Gilmer County in 1909 and 787 calves and 13,070 other cattle sold or slaughtered in Lewis County.

Dairying is not developed to an appreciable extent in the area, but nearly every farm has a few milch cows. These are largely Jersey, though there are a few Holstein and Shorthorn herds. In 1909 the value of dairy products, excluding milk and cream used on the farms, was \$79,075 in Lewis County and \$50,841 in Gilmer County.

Hog raising is not so well developed as cattle raising, but hogs are kept in considerable numbers on every farm. Most of the animals are of improved breeds, there being very few of the native scrub stock, except in the more remote parts of Gilmer County. Berkshire, Poland China, Chester White, and Jersey Red are the leading breeds. Many of the animals are of these breeds mixed. In 1909 hogs sold or slaughtered on farms in the two counties had a total value of \$11,765.

The sheep-raising industry was better developed during the period 1860-1890 than it has been since that time. The Merino was the first breed introduced. These animals were kept largely for the wool. The Cotswold, Southdown, Dorset, and Shropshire were introduced later. During the last 20 years little attention has been given to sheep, and the breeds have become badly mixed. Sheep at the present time are raised largely for supplying mutton and for the lambs. These are shipped to the larger markets, such as Pittsburgh and Baltimore. The value of sheep and goats sold or slaughtered in 1909 in the two counties amounted to \$26,617, and that of wool and mohair produced reached \$34,285.

The horses raised upon the farms are sufficient to supply the farm demands. Probably one-half the colts are of the draft type, the others being of standard breeds or saddle horses. About 75 per cent of the draft horses used in the area are brought in from other States, for use mainly in the oil fields.

The lack of interest in farming that followed the oil and gas development in Lewis and Gilmer Counties has changed during the last five years. The farms are passing into the hands of men more interested in agriculture, and are being brought back to their former state of productiveness. Large areas of bluegrass pasture that were allowed to grow up in weeds and broom sedge are now in good condition. The hay lands are cut more frequently and grass land is resodded more regularly.

Most of the hill land is in permanent bluegrass pasture, remaining uncultivated except when a sod begins to fail and must be renewed. Many of the gentler slopes and much of the ridge-top land is cultivated and the bottom land in general is devoted either to corn or hay.

The influence of soil, topography, and physiography upon the agriculture is marked. Lewis County, in which the proportion of bottom land and terrace soil is the greater, is the more advanced of the two counties. The upland soils are much the same in the two counties, with the exception that in Lewis County the topography is slightly less broken. As the soils of the area in general are adapted to grass and much of the land is too steep for successful cultivation, although suitable for use as pasture, stock raising has become the dominant agricultural interest. The distance from large markets is another factor that has restricted the agriculture to stock raising and general farming.

Some recognition is given by the farmers to the adaptation of crops to certain soils. The bottom lands are well suited to corn, and large areas here are planted to this crop. The red hill land is considered best for wheat, clover, and grass, as well as the best upland soil for corn. Clover is grown more extensively upon the red land than upon other soils, but grass is less extensively grown, as this land is used more generally for other crops than are the other upland soils. The terrace soils are considered the most desirable for potatoes and other vegetables, and such crops as soy beans and cowpeas. These crops, however, are not grown extensively.

The draft animals used on the farms are in general of good stock, and the implements employed are of modern type. Labor-saving machinery is used to whatever extent the topography and the system of farming permit. Such implements as mowers, reapers, hayrakes, tedders, heavy turning plows, sulky plows, cultivators, disks, harrows, grain and fertilizer drills, manure spreaders, and double or hillside plows are part of the equipment of most of the farms, especially those on the terrace soils. The hill farms are as a rule not quite so well equipped. In the rougher sections of Lewis County, as well as over most of the hill land in Gilmer County, the farm machinery is of a less improved type, but mowers and moderately heavy turning plows are used, and spike-tooth and spring-tooth harrows are common. Cradles are used in harvesting and much of the cultivation is done with hoes or single-draft plows.

In breaking sod land the depth of plowing ranges from 6 to 8 inches. The land is run over with the spike-tooth or spring-tooth harrow. Cultivation upon the hill land is usually done with plows and hoes. Upon the terrace and bottom land areas the plowing is usually deeper and disk harrows are generally employed, subsequent tillage being performed largely with cultivators.

Hay is usually stacked in the field and inclosed, so that stock can graze over the land. Later the fence is removed and the stock eats from the stack during the winter. The barns are usually filled with the best grade of hay and that which contains weeds is, as a rule, stacked in the open. Broom sedge, oxeye daisy, blue devil, plantain, and other growths lessen the value of the permanent pastures to a considerable extent. In some instances these weeds seriously injure the value of the hay crops for years before the land is reseeded.

Although the crop system in general results in an alternation of the crops produced on any one field, there is no systematic rotation followed in general by the farmers. Upon hill land not in permanent pasture sod which has been in mowing is turned under and planted to corn. Winter wheat is sown upon the corn stubble and harrowed in. Grass seed usually is sown with the wheat, timothy and clover being seeded for hay, and bluegrass if permanent pasture is desired. The grass is usually cut for a period of four to seven years before the sod is turned again. The bluegrass pastures remain for indefinite periods, some having stood for 40 years without reseeding.

Upon the terraces more cultivated crops are grown than upon the hill land, consequently the number of years that a field is allowed to stay in sod is comparatively short, and as a rule the land is not put in permanent pasture. The rotation most commonly followed consists of corn, oats followed by cowpeas, corn, and winter wheat, followed by timothy and clover cut for two or three years. Upon the bottom land some of the fields are planted to corn for many years in succession, while others are kept in permanent sod. Timothy usually is sown upon the corn stubble and cut for hay until the stand begins to fail, when the sod is used for pasture or the land is put in corn for a number of years.

In 1910 only 1.8 per cent of the farmers of Gilmer County reported the use of commercial fertilizer, with a total expenditure of \$398, while in Lewis County 18.2 per cent of the farmers reported its use. Most of the fertilizer is used upon the terrace farms, but the practice of fertilizing is spreading to the hill land. No commercial mixtures are applied on the bottom-land soils. According to local information, the use of fertilizer has increased considerably during the last few years. At the present time only a small proportion of high-grade complete fertilizer is used, farmers depending mainly upon some form of phosphate carrier, either bone meal or 16 per cent acid phosphate. The complete fertilizer is used upon gardens and upon other crops grown on small plots. Bone meal or acid phosphate usually is applied upon upland or terrace soils at the rate of 250 to 300 pounds per acre for corn and 300 to 500 pounds per acre for wheat.

The barnyard manure is used upon gardens, intensively cultivated crops, and corn. Sod is turned under occasionally as a means of increasing the organic matter content of the soils. Clover and cow-peas are grown by a few of the more progressive farmers to increase the nitrogen in the soil. The turning under of green crops is not practiced.

Liming has not become general, owing to the high cost of transportation. A thin limestone stratum (Redstone limestone) outcrops over the area, occurring in the horizon between the Pittsburgh coal and the Redstone coal. The outcrop is not continuous, but where encountered it is 3 to 6 feet in thickness. This seam has been opened at several places and the rock taken out for burning. At Mineral, in Harrison County, a limestone pulverizer is operated, making crushed lime available to the farmers in that locality.

It is difficult to obtain labor upon the farms of the area, as much of the efficient labor has been attracted to the oil and gas fields, allied industries, and public works, where the wages range a little higher than upon the farms. Farm labor is paid on the average about \$1 to \$1.50 a day, while the wages paid in other industries range from \$1.50 to \$2.50 a day for ordinary laborers, skilled labor commanding a much higher price. Wages range slightly higher in Lewis County than in Gilmer County. Most of the farm labor is performed by the farmer and his family. In the 1910 census 65.2 per cent of the farms in Gilmer County reported outlay for labor in 1909, with a total expenditure of \$92,827; in Lewis County 60 per cent reported the hire of labor, with a total expenditure of \$112,272.

The average size of farms in Gilmer County, as reported by the 1910 census, is 116.5 acres, and in Lewis County 134 acres. The census shows little change in the average size of farms in the last 20 years.

The proportion of farms operated by tenants is small, and the census reports for the last 30 years show no appreciable change in the percentage. According to the 1910 census, 80.6 per cent of the farms in Gilmer County are operated by owners, 18.9 per cent by tenants, and 0.5 per cent by managers. In Lewis County, 81.9 per cent are operated by owners, 17 per cent by tenants, and 1.1 per cent by managers.

In Gilmer County there are 315 tenant farmers, of whom 195 rent on shares, 95 for cash, and the remainder on a mixed cash and share basis.

Of the 309 tenant farms in Lewis County, 209 are rented for cash. The terms of the leases vary between wide limits. The land in the better developed communities usually rents for cash, the amount varying with the locality and the desirability of the land. In the more remote sections the terms are usually adjusted to suit the con-

ditions of the contracting parties. When bottom land is rented on the share basis the owner furnishes only the land and receives one-half of all the field crops or two-thirds of the corn crop. In the case of the hill land, when the owner furnishes only the land he receives a very small proportion of the crop, about one-fourth. In many cases, however, the renters of the hill land are in such poor financial condition that much of the farm equipment is furnished by the owner. In this case the crop is divided equally.

Cash rent usually amounts to 5 or 6 per cent of the taxable valuation of the land, the rent ranging from \$1 to \$10 an acre. This, however, is not the case with the terrace lands, on which the rent is in many cases entirely out of proportion to the valuation, the agricultural value of the land being incidental to its industrial value.

The bottom land brings the highest rental. Pasture land rents for \$1 to \$3 an acre.

The value of all farm property in Gilmer County, according to the 1910 census, is \$4,981,965. Of this amount, \$3,298,206 is represented by land, \$692,876 by buildings, \$107,115 by implements, and \$883,768 by domestic animals. In Lewis County the land is valued at \$7,249,240, buildings at \$1,442,700, implements at \$160,-253, and domestic animals at \$1,350,626, making a total of \$10,202,-819. The average assessed value of land in 1910 was \$17.03 an acre in Gilmer County and \$29.81 an acre in Lewis County.

Over part of Gilmer County and most of Lewis County the farmers are in good financial condition. The rentals, and in some cases royalties from the lease of oil and gas lands, the receipts from the sale of timber and coal and rights of way, and the general growth of ready markets as a result of oil and gas development have increased the prosperity of the farming population. This satisfactory condition is shown by the character of the farmhouses, barns, silos, and other improvements on the average farm.

SOILS.

Lewis and Gilmer Counties lie wholly within the Appalachian Mountains and Plateau Province, which extends from Pennsylvania on the north to Alabama on the south and includes the entire State of West Virginia. The upland soils of this province are of residual origin, being derived by weathering from the underlying rock formations. The soils of Lewis and Gilmer Counties are derived from the rocks of the "Upper Coal Measures."¹

The character of the underlying geological formations plays an important part in the distribution and topography of the soils.

¹ The discussion of the geology is based upon the work of the West Virginia and U. S. Geological Surveys.

The Dunkard formation, which is approximately 550 feet thick and consists of alternate strata of sandstone and gray and red shale, outcrops over the northwestern one-third of the area. This formation gives rise to soils whose topography in general is steep and broken. The strata rise to the southeast and the rocks of the Dunkard formation soon outcrop upon the hilltops. In the vicinity of Copley this formation dips into a syncline which brings it down near stream level.

The Monongahela and Conemaugh formations cover the remainder of the area, except the extreme southern part of Lewis County. They have a combined thickness of nearly 1,000 feet and consist mostly of gray shales, with thin sandstone strata and well-defined belts of red shale. Over the section in which these formations outcrop the surface of the land is comparatively smooth, although the slopes may be steep.

In the southern part of Lewis County, in what is known as the "shoe string," the Allegheny and Pottsville formations come to the surface. These formations have a combined thickness, exposed, of about 500 feet and consist of sandstone interbedded with shale formations, the former predominating.

The soils of Lewis and Gilmer Counties fall into three natural divisions: Upland or residual soils, terrace or old-alluvial soils, and first-bottom or recent-alluvial soils. For convenience of classification the soils are grouped into series, the soils within a series resembling one another in general characteristics, such as mode of formation, color, topography, and drainage conditions, and differing in texture, that is, in the relative proportions of stone, gravel, sand, silt, and clay.

The upland or residual soils are derived from the weathering in place of strata of sandstone, gray shale, and red shale. They are grouped in the Dekalb, Upshur, and Meigs series.

The Dekalb series includes types having gray to yellowish-brown surface soils and yellow to yellowish-brown subsoils. They are derived from the weathering in place of gray sandstone and gray shales. Two members of the series are mapped in this area, the stony silt loam and silt loam.

The Upshur series has reddish-brown, Indian-red or red surface soils and red to Indian-red subsoils. It includes soils derived from red shale that is more or less calcareous. The Upshur silty clay loam is the only member of the series represented in Lewis and Gilmer Counties.

The soils of the Meigs series represent intermingled Upshur and Dekalb material undifferentiated. They are derived from alternating thin layers of sandstone and gray and red shale. The clay loam is the only type of the Meigs series mapped in this area.

The terrace or second-bottom soils consist of old alluvium, derived by wash from the soils that occur over the drainage basin of the streams along which they are developed. The terrace deposits are the result of a local base level having been formed while the stream was cutting through a hard sandstone stratum, the flow being at a higher level than at present. In such case the sandstone supports the terrace. The difference in color between the terrace soils and the bottom-land soils is possibly due to the leaching out, in the case of the older alluvium of the terraces, of the fine material that gives the red color to the first-bottom types.

The terrace soils in this area are classed in the Holston series. This series is characterized by gray to yellowish-brown surface soils and, yellow to yellowish-brown subsoils. The soils of this series are derived from material eroded from sandstone and gray and red shale, the deposits having been modified to some extent by subsequent erosion. The silt loam is the only Holston soil mapped in Lewis and Gilmer Counties.

The soils constituting the present flood plains of the streams vary with the character of the rocks occupying the different drainage basins from which the soil materials have been washed. The alluvium differs enough to make it necessary to separate the first-bottom soils into two series—the Moshannon series and the Pope series.

The Moshannon series includes types having a reddish-brown surface soil and a reddish-brown to red subsoil. They represent material which has been washed from the upland soils, principally those of the Upshur and Meigs series.

The soils of the Pope series are yellowish brown throughout the entire 3-foot profile, the subsoil being slightly lighter in color than the surface soil. These soils represent materials washed from the upland sandstone and gray shales and deposited by the streams during overflows. The Pope sandy loam and silt loam are mapped in this survey.

Rough stony land includes inextensive areas of steep land of stony nature, mainly in forest and largely nonagricultural.

The table following gives the physiographic group and the source of material of each type mapped.

Classification of the soils according to physiography and mode of formation.

Group.	Origin.	Soil type.
Upland, or residual soils.	Residual from sandstone and gray shale, with sandstone predominating.	Dekalb stony silt loam.
	Residual from sandstone and gray shale, with gray shale predominating.	Dekalb silt loam.
	Red shale (calcareous).....	Upshur silty clay loam.
	Alternating sandstone, gray and red shale, and sandstone strata.	Meigs clay loam. Rough stony land.
Terrace, or old-alluvial soils.	Wash from upland soils, modified by erosion and influenced by underlying shale.	Holston silt loam.
First-bottom, or recent - alluvial soils.	Derived by wash from mixed Upshur and Meigs material.	Moshannon silt loam.
	Derived by wash from mixed Dekalb and Meigs material.	Pope sandy loam. Pope silt loam.

In subsequent pages of this report the various soil types recognized are described in detail, and their relation to the agricultural economy of the area discussed. The map accompanying this report shows the distribution of the various types, and the following table their actual and relative extent.

Areas of different soils.

Soil.	Acres.	Per cent.	Soil.	Acres.	Per cent.
Dekalb silt loam.....	169,280	36.1	Dekalb stony silt loam	2,880	0.6
Meigs clay loam.....	139,328	29.7	Pope silt loam.....	1,664	.4
Upshur silty clay loam.....	106,048	22.6	Pope sandy loam.....	512	.1
Moshannon silt loam.....	36,352	7.7	Total.....	469,120
Rough stony land.....	6,912	1.5			
Holston silt loam.....	6,144	1.3			

DEKALB STONY SILT LOAM.

The surface soil of the Dekalb stony silt loam is a grayish-brown to yellowish-brown, friable stony silt loam, ranging in depth from about 4 to 8 inches. The subsoil is a brownish-yellow or pale-yellow stony silt loam to stony silty clay loam. The stones are scattered over the surface and throughout the 3-foot profile in varying quantities. They consist of fragments of sandstone and shale in different stages of decomposition, and vary from place to place in the predominance of sandstone or shale. Large boulders and bedrock outcrops are encountered in spots, but, being scattered, they detract from the agricultural value of the soil only locally. The bedrock is often encountered within the 3-foot section. Small areas of stony loam and sandy loam, as well as of Rough stony land, are included in this type as mapped, the developments being too small to separate.

The type is encountered in the extreme southeastern part of Lewis County. Its extent in this area is relatively small, but extensions of the type cover the greater part of a number of counties in southeastern West Virginia.

The topography of the Dekalb stony silt loam is decidedly steep and broken, the areas occupying positions along the steep slopes of stream valleys. The run-off consequently is very rapid.

The native forest growth on the Dekalb stony silt loam consists of white and chestnut oak, spruce pine, chestnut, poplar, and mountain laurel.

This soil is not extensively used for agriculture, probably less than 30 per cent of its total area being cleared. Most of the cleared land is in pasture, but corn is grown in patches here and there on the more gently sloping areas. This grain is the only cultivated crop of importance. Yields range from 20 to 30 bushels per acre. Most of the common vegetables grown in this section of the State are cultivated in gardens. There are several small farm orchards on this type, in which apples predominate. The live stock kept is restricted to a few head of cattle of mixed beef types, together with sheep and hogs.

The steep topography and the stone content make cultivation of this soil difficult. In plowing, the rows are run with the contour of the hills. Spring-tooth harrows are used to some extent in preparing the land. Most of the cultivation is done with the hoe, and the farm work is mainly done under inefficient methods. No fertilizer is used.

Land of the Dekalb stony silt loam is not valued highly for agriculture, selling prices ranging from \$5 to \$20 an acre.

The methods of improving this soil are essentially the same as those suggested for the Dekalb silt loam, next described.

DEKALB SILT LOAM.

The surface soil of the Dekalb silt loam is prevailingly a grayish-brown to yellowish-brown, friable silt loam, about 6 to 8 inches deep. The subsoil is a brownish-yellow or reddish-yellow to buff-colored silty clay loam, friable and compact. Both surface soil and subsoil contain a small proportion of partially decomposed gray shale and sandstone fragments, and in spots the quantity of stone is sufficient to make the soil a stony loam. In general, weathering has taken place to a considerable depth, and in only a few places is the parent rock encountered within the 3-foot profile. In many places the immediate surface when very dry has a grayish color, little brown or yellow being apparent.

The type is developed predominantly in irregularly shaped bodies widely distributed over the area. It occurs upon hillsides, on benches, and over the tops of ridges. The topography is steep to gently sloping, but the surface in general is moderately smooth. The run-off is

rather rapid and drainage is excessive, but this type does not seem to suffer as much from erosion as do some of the other upland soils.

The Dekalb silt loam of this area adjoins developments of the Westmoreland silty clay loam in Harrison County. The Westmoreland soils are virtually Dekalb soils influenced by limestone. In this area the limestone strata have become so nearly negligible that there is not sufficient calcareous influence in the soil to justify its classification with the Westmoreland series.

Probably 25 per cent of the Dekalb silt loam is in forest, the growth being composed largely of white, red, and chestnut oak, poplar, walnut, hickory, ash, chestnut, and beech, with a scattered occurrence of pine. In the fields a considerable number of walnut and hickory trees have been left standing. Probably 80 or 90 per cent of the cleared land is devoted to pasturage. Some of the more favorably located areas, such as bench land, the broader and smoother hilltops, and the more gentle slopes are in cultivation. Most of the corn fields noticed on the steep slopes in the course of the soil survey represent a transition to permanent pasture.

Of the crops grown, timothy for hay probably covers the largest acreage. Corn comes next and oats occupy a small acreage. Timothy and clover mixed occupy a larger acreage than any cultivated crop, with the exception of corn, and clover alone is grown to some extent. Cowpeas are a minor crop and sorghum, rye, millet, Irish potatoes, sweet potatoes, and buckwheat are grown in small patches, as well as nearly all the common garden vegetables. Irish and sweet potatoes are grown in sufficient quantity to afford occasionally a surplus, which is disposed of locally.

Several commercial apple and peach orchards have been established upon this soil, many of the orchards consisting of peach trees planted between apple trees. The plantings seem to be in a thriving condition. Nearly every farm has a small orchard containing a variety of fruits, apples predominating, followed by cherries, peaches, pears, and plums, fruit being grown in sufficient quantity to supply home demands and occasionally leave a small surplus for market.

Considerable live stock is kept on the Dekalb silt loam, mainly beef cattle. Sheep, horses, and hogs are raised on each farm.

The yields upon this soil have a wide range, owing to the variety of farming methods followed. Where efforts have been made to build up the soil by such means as turning under green manure or applying lime, barnyard manure or commercial fertilizer, the yields are invariably good. Corn yields ordinarily 15 to 40 bushels¹ per acre, wheat 15 to 25 bushels, and oats 20 to 30 bushels. Potatoes yield 100 to 250 bushels per acre, the yield varying with the season and with the quantity of manure and commercial fertilizer applied.

¹ The statements made in this report as to yields are based upon information obtained from farmers.

Timothy hay yields on the average about 1 ton per acre in ordinary seasons. Liming is not a general practice, but 250 to 300 pounds per acre of bone meal or acid phosphate is used by some farmers preceding corn or wheat. Wheat is rarely grown without the use of fertilizer.

This soil generally is deficient in organic matter and lime. It could be improved by turning under a sod every three or four years and applying 1,000 to 2,000 pounds per acre of burnt lime or its equivalent in crushed limestone. More frequent growing of clover, cowpeas or soy beans in the rotations, and acreage applications of 300 to 600 pounds of phosphate fertilizers preceding grain crops and of about 500 to 600 pounds of complete fertilizer upon potatoes and other vegetables, would be beneficial.

The Dekalb silt loam is well suited to the production of Irish potatoes, as evidenced by the excellent results obtained with this crop in other counties of the State. Soy beans make an excellent hay crop and also serve the purpose of adding nitrogen and organic matter to the soil. Tobacco is grown successfully upon this soil in other parts of the State, bright Burley tobacco of excellent quality and good weight being produced with the use of 1,000 to 1,200 pounds per acre of tobacco fertilizer containing 8 per cent phosphoric acid, 4 per cent nitrogen, and 6 per cent potash. The Dekalb silt loam is well suited to apples and includes many excellent orchard sites. The fruit is well formed and of good color and flavor, and the trees are usually in a healthy condition where they are given care.

UPSHUR SILTY CLAY LOAM.

The surface soil of the Upshur silty clay loam is an Indian-red or dark reddish brown to red, friable silty clay loam, 6 to 8 inches deep. The subsoil is an Indian-red to purplish-red, somewhat compact silty clay loam to clay. The subsoil is in some places calcareous. It becomes heavier and more compact with depth. Fragments of red and gray shale are encountered in places in the deep subsoil, but as a rule weathering has taken place to a greater depth than 40 inches. A characteristic feature of the soil is that it is friable to brittle when dry and very plastic and tenacious when wet. In scattered spots the soil covering has been wholly or partially removed by erosion, exposing the Indian-red clay. Here the soil bakes and cracks deeply upon drying out. This tendency seems to be characteristic of the soil itself, where the organic matter has been depleted.

The Upshur silty clay loam has a more general distribution than any other type in the two counties. It occurs in very narrow strips winding around the mountain sides at definite elevations and occupying definite positions. The topography varies, the areas forming steep hillsides, the more level benches or the rounded hilltops.

The surface is sloping enough in all cases to insure good drainage. The water-holding capacity of the soil seems greater than that of the lighter soils.

The Upshur silty clay loam is derived from the weathering in place of more or less calcareous red-shale strata which vary in thickness, but outcrop at nearly equal elevations throughout the area. The formation thins so rapidly toward the north, however, that the soil in the Harrison County soil survey corresponding to the Upshur silty clay loam was not considered extensive enough to warrant separate mapping.

The remaining timber growth on the Upshur silty clay loam consists mainly of oak. There are also large numbers of hickory and walnut trees which were left standing when the land was cleared, with scattered specimens of maple, ash, poplar, chestnut, and locust.

This type is recognized as the strongest upland soil in the area, and about 80 per cent of it is cleared and under cultivation or in hay or permanent pasture land. Possibly 60 per cent of the type is in permanent sod, the remainder being divided between corn and timothy and clover. The other crops, including oats, wheat, and cowpeas, occupy relatively small areas. A large number of beef cattle are grazed, this type supporting a larger number of animals per acre than any other soil. A small number of sheep and a few horses also are pastured.

This soil supports an excellent bluegrass sod, the stand including little broom sedge, other grasses or weeds. The sod usually remains good during dry periods and lasts for an indefinite number of years. Bluegrass comes in voluntarily, but the grass is seeded in order to insure a good stand. For hay, timothy alone generally is seeded, but in some cases clover is sowed with the timothy, and occasionally clover is sowed alone. Timothy and clover mixed and clover alone are grown more extensively on the Upshur silty clay loam than upon any other type, and clover is much more successful on it than on any other soil. The yield of hay ranges from 1 to $1\frac{1}{2}$ tons per acre.

Corn gives better yields upon this soil than upon the other upland types, the yields ranging from 25 to 60 bushels per acre, with an average of 40 bushels. Wheat and oats also do better on this type than on any of the upland soils, wheat yielding from 12 to 30 bushels and oats from 25 to 45 bushels per acre. Tree fruits do fairly well, but they do not thrive as upon some of the other soil types, and consequently the Upshur silty clay loam is used for fruit only to a very limited extent.

In preparing this type for planting, sod land is plowed deeply in late winter or early spring, so as to subject the soil to alternate freezing and thawing. One reason for winter plowing is the tendency of

this soil to remain wet until late in the spring. The land is disked thoroughly or harrowed before planting. The heavy, intractable nature of this soil makes cultivation difficult. Care must be exercised not to plow the soil when it is too wet, as clodding results.

Where corn is to be planted stable manure is added if available and convenient, and usually about 250 to 500 pounds of bone meal or acid phosphate is applied to the acre. If wheat, oats, timothy, clover, or bluegrass is seeded, about 500 pounds of lime or 250 to 300 pounds of bone meal or phosphate per acre usually is applied.

The price of land of this type does not vary so widely as that of some of the other soil types. It is held at \$30 to \$60 an acre.

This soil is naturally durable and productive. If sod is turned under at intervals and about 500 to 1,000 pounds of lime is applied to the acre once in every three or four years, with an application of 250 pounds per acre of acid phosphate or bone meal preceding a grain crop, good yields can be maintained. Liming is not so essential upon this type as upon the Dekalb or Meigs soils, but good results are had from its moderate use. Under the present system of farming extensive manuring is not possible. This type needs the incorporation of organic matter in large quantities to improve the structure and deepen and mellow the soil. When sod begins to thin, the addition of bone meal, lime, or manure usually is effective. When this proves of no avail the field should be reseeded. Reseeding, however, is seldom necessary.

Upon soil of this nature crop rotations should be arranged so as to require as little plowing as possible. The more extensive growing of clover and of oats and wheat upon the areas of the type that are topographically suited to cultivation would be profitable.

MEIGS CLAY LOAM.

The Meigs clay loam as encountered in this area is characteristic of the type as mapped in the counties to the west. It consists of undifferentiated, intermixed Upshur and Dekalb material. The soil ranges in spots from Upshur clay through Upshur silty clay loam and silt loam to Dekalb silty clay loam and silt loam. In some of the included spots these various soils are encountered in typical developments.

The Upshur clay has a very shallow surface soil of dark-red or Indian-red clay loam and a subsoil of heavy, compact, Indian-red clay, which is friable and brittle when dry and plastic when wet. The Upshur-silt loam usually consists of a brown to yellowish surface soil, about 6 to 8 inches deep, underlain by a red to Indian-red subsoil. The Dekalb silty clay loam has a gray to yellowish-brown silty clay loam surface soil, about 6 to 8 inches deep, underlain by a yellowish-brown to yellow silty clay loam to clay. The greater part

of the soil mapped as Meigs clay loam consists of Upshur silty clay loam and Dekalb silt loam material so intricately mixed that it could not be separated in mapping. These two types are described in detail elsewhere in this report.

A characteristic of the Meigs clay loam is the large quantity of partially decomposed shale and sandstone fragments occurring throughout the surface soil and subsoil. The parent rock material often is encountered within the 3-foot section.

The rock from which this soil is derived consists of alternate strata of red and gray shale and sandstone. The topography usually is steep and considerable mixing of the weathered materials has taken place, the result of "slips" giving way to underlying sandstone strata and the precipitation of the mass of material down the hillsides. In places, however, the horizons of the strata are fairly well shown in the soil areas.

The Meigs clay loam is extensively developed in the northern part of the area, forming a northeast-southwest belt along the northern border of Gilmer County from the Calhoun County line through Lewis County to Kincheloe Creek. As the formations from which the type is formed rise to the southeast the underlying formations gradually come to the surface, and the Meigs clay loam is confined to the hill-tops over most of the area. The elevation of the type varies with the rise and fall of the formations incident to the anticlines and synclines that exist in the area. The type is encountered in large developments around Copley, owing to the dropping of the formations into the Copley trough. The formations giving rise to this soil disappear in the southern part of Lewis County. A large development of the Meigs clay loam occurs between the Right Fork of Steer Creek and the Calhoun County line. Here the type has been formed from rocks giving rise to other soils elsewhere in the area, but the topography is very steep and broken and the formations are so mixed that it is impossible to separate the Upshur silty clay loam and Dekalb silt loam.

In many instances in the better developed sections of the area the boundary between the Meigs clay loam, occupying the hill and ridge tops, and the Upshur silty clay loam can be traced by the woods line, the Upshur soil being cleared while the Meigs clay loam is invariably forested. Most of the valuable timber has been removed, and the forested areas largely represent cut-over land. The tree growth consists mainly of white, red, and chestnut oak, poplar, and chestnut, with scattered hickory, walnut, beech, maple, and locust trees.

About 30 per cent of the Meigs clay loam is cleared and farmed, most of the improved land being in permanent pasture. Corn and hay each occupy an acreage larger than that of all the other crops combined. Wheat, oats, and rye are grown to some extent on the

more favorably located areas. Of the hay crops, timothy is far in the lead; timothy and clover mixed and clover alone are grown upon a small acreage, and millet and cowpeas are minor crops. Potatoes and vegetables are produced for home use, and there are small home orchards on nearly every farm. Apples are the leading fruit and the trees seem to be in a flourishing condition. A large number of beef cattle and sheep are grazed upon this soil.

Corn yields 15 to 45 bushels per acre, the higher yields usually being obtained upon the spots of red soil or where fertilizer is used. Wheat usually is grown upon the red land and yields 10 to 20 bushels per acre. Timothy hay yields range from one-half ton to 1½ tons per acre. Over much of the type the land is so steep as to preclude the use of mowers, and the production of hay is confined to the bench lands and the flatter ridge tops. Bluegrass sod holds fairly well upon the Upshur areas but fails upon the included Dekalb soil, broom sedge and other weeds coming in rapidly, so that the fields must be reseeded often.

The methods of farming employed on the Meigs clay loam depend upon the predominance locally of the Dekalb silt loam or the Upshur silty clay loam. The topography in general is too steep for the use of improved implements. Agriculture in general is not very far advanced, owing not only to the unfavorable topography but also to the location of most of the type at a distance from transportation facilities and at high elevations.

The value of land of the Meigs clay loam ranges from \$10 to \$25 an acre.

The means of improving the soil suggested for the Dekalb silt loam and the Upshur silty clay loam, respectively, are beneficial upon the Meigs clay loam, according to the predominance from place to place of the Dekalb or Upshur soil. It is not advisable to put the land in tilled crops. As erosion is active, it is well in most areas to maintain a healthy sod cover, and the stand should be rejuvenated or replaced before erosion denudes the hillsides of soil covering. In clearing the land, as well as in changing from an old to a new sod, the soil should not be left exposed longer than necessary. In rejuvenating old sod, the use of bone meal and lime are valuable. The distance which lime must be hauled is a factor that prohibits its use over much of the type. Phosphatic fertilizers have been found beneficial in growing the grain crops.

HOLSTON SILT LOAM.

The surface soil of the Holston silt loam as typically developed is a light-brown to yellowish-brown, mellow silt loam, about 8 to 12 inches deep. This is underlain by a yellowish-brown or yellow, somewhat compact and friable, heavy silt loam to silty clay loam, which

extends to a depth of 3 feet or more. The surface material has a tendency to turn gray when thoroughly dry. In small areas, mainly upon the terraces south of Jackson Mill, the soil contains a noticeable proportion of fine sand. In other small areas, mainly along the Little Kanawha River, the subsoil is reddish brown in color.

The Holston silt loam is a second-bottom or terrace soil, representing a former flood plain of the streams along which it is developed. The surface in general is level to only gently undulating, but surface drainage is good. The type lies from 20 to 100 feet above the stream levels, but only small areas lie at the higher elevations, and along the larger streams most of the areas are from 30 to 60 feet above the streams. The relative elevation is less along the smaller streams, rarely over 30 feet above the channel. The original alluvial deposits giving rise to the Holston silt loam have suffered severely from erosion, and residual material forms part of the soil.

The original forest growth on the Holston silt loam consisted largely of oak, chestnut, poplar, sycamore, and beech.

Practically all the type is cleared and farmed. Only a small acreage is in permanent pasture or hay land. A large total area is devoted to corn. Wheat, oats, rye, Irish potatoes, sweet potatoes, clover, cowpeas, soy beans, and millet are grown more extensively than upon any other type in the area. Fruits, including apples, cherries, and grapes, are grown, and do fairly well, though apples do not reach the perfection that they attain on the hillside soils. Blackberries, raspberries, and strawberries thrive, the last two being grown for market. Fewer beef cattle and sheep, but perhaps a larger number of horses, milch cows, hogs, and chickens, are kept upon this type than upon any other.

Crop yields vary widely, according to the fertilizers used and the condition of the land. Corn yields 25 to 65 bushels per acre, wheat 10 to 25 bushels, oats 20 to 50 bushels, and hay from one-half ton to 2 tons per acre. Yields of Irish potatoes range from 100 to 300 bushels per acre. Cowpeas and soy beans do well.

Before development of the oil and gas resources began, farms on the Holston silt loam in general were well managed and in a high state of cultivation. Since that time, however, labor has been scarce and attention has been diverted from agriculture to the extent that most of the farms have deteriorated and the soils are considered worn out through the depletion of the organic matter. Several farms, however, have been continuously maintained in a high state of productiveness, and many others have been taken in charge recently. The efforts made to improve the soil consist in turning under worn-out sod, plowing under an occasional crop of cowpeas or clover stubble, and applying lime at the rate of about 500 to 1,000 pounds per acre, and bone meal or acid phosphate preceding corn,

wheat or oats, at the rate of 250 to 300 pounds per acre. Upon many of the farms nothing is done to maintain the productiveness of the soil, and on these the yields steadily decrease.

The topography is better suited to cultivation than that of most of the soils, and improved machinery can be used in farming. Disk harrows and cultivators are in more common use upon this soil than upon any other. Most of the silos in use are on farms on this soil. The farms are mainly small. The greater number of the towns of the area have been established upon this type.

The value of land of the Holston silt loam ranges widely. In undeveloped localities it is valued at \$40 to \$60 an acre, while in other sections of the area, as below Weston, along the West Fork River and along Hackers Creek, it is valued at \$100 to \$200 an acre.

The incorporation of large quantities of organic matter would materially increase the productiveness of this soil. The growing of cowpeas and soy beans and the turning under of occasional green crops would increase the organic content. Not enough stable manure is available under the present system of farming to treat more than small patches of potatoes, sweet corn, and garden vegetables. An acreage application of about 1,000 pounds of burnt lime or 2,000 pounds of crushed limestone when sod is turned under gives good results. It is good practice to apply 250 to 500 pounds per acre of bone meal or acid phosphate before putting in grain crops, and a complete fertilizer is beneficial upon potatoes and other vegetables, to be distributed at the rate of not less than 600 pounds per acre. It would be advisable in farming this soil to follow a short crop rotation, covering two years, and to grow more cultivated crops.

The Holston silt loam is one of the best soils in the State for Irish potatoes, and is used extensively for this crop in other counties. The production of Irish potatoes upon a commercial scale, as well as of other vegetables, would apparently prove profitable.

Experiments with alfalfa upon this soil have apparently been successful, and on at least one farm the crop is grown on a considerable acreage. Alfalfa has succeeded upon this soil in other parts of the State after the land had been heavily limed and inoculated and brought to a high state of cultivation. Burley tobacco has been grown successfully upon this soil in the southwestern part of the State.

MOSHANNON SILT LOAM.

The Moshannon silt loam has a surface soil about 8 to 14 inches deep, consisting of an Indian-red or dark reddish brown, mellow silt loam. The surface soil grades imperceptibly into the subsoil, the latter consisting of an Indian-red or reddish-brown silt loam to silty clay loam, slightly compact but friable. Beds of sandstone gravel

are encountered in places in the lower part of the 3-foot section. In places near the stream channel the soil grades toward a loam or sandy loam.

The Moshannon silt loam occupies 56.8 square miles. The type usually is developed along streams that derive their wash largely from Upshur material. It occurs as almost level bottom land, with occasional swells lying 3 to 20 feet above stream level. In many places, usually along the large streams, the type lies above normal overflow, but even here it is subject to occasional inundation. Drainage, however, is well established. The overflows are actually a benefit, each inundation leaving a layer of rich sediment. The heavy floods usually occur in the early spring before planting time, but late August floods sometimes do considerable damage to corn.

The original forest growth on this type, as evidenced by the few remaining trees, consisted of sycamore, elm, beech, birch, and willow. Nearly all the type is cleared, and about one-half of it is in permanent sod. The greater part of the cultivated land is used for corn. This soil is depended upon largely for the corn production of the two counties and it rivals in point of quality and yield of this grain the best soils of the "Corn States." Although most of the silos are situated on second-bottom or upland areas, the corn used for ensilage is to a large extent produced upon the bottom land of this type. A small acreage of sorghum is grown for the making of molasses. Timothy and millet are the chief hay crops. Oats and wheat are unimportant.

A large number of beef cattle are kept upon this type, the stock being grazed and fed hay, ensilage, and ear corn. Most of the grass land is cut for hay once or twice a season and grazed after the last cutting. Some of the bottom land is in permanent pasture, furnishing good grazing even in the driest years. A number of horses are pastured, but few sheep or hogs are kept on the farms.

Corn on the Moshannon silt loam yields 40 to 80 bushels per acre, the average being about 50 bushels. Oats and wheat give heavy yields, but these crops have a tendency to lodge. Millet makes a heavy growth. Timothy yields from 1 to $2\frac{1}{2}$ tons of hay per acre. Where a second cutting is made the quality of the hay is considered better, but the yield is usually low.

No fertilizer, lime or stable manure is commonly used upon the type, except on the higher lying land which is subject to only occasional overflow. No definite system of crop rotation is followed, the fields being used for one crop indefinitely. Changes from hay land to corn or vice versa are rare. The soil is easy to handle, as it forms a mellow seed bed with very little cultivation.

The value of land of the Moshannon silt loam ranges from \$40 to \$200 an acre, the higher prices being confined to land in very desirable situations.

As the outstanding need of the county is the production of more corn, this soil can most profitably be utilized for growing this staple. More attention could well be given to careful selection of the variety of corn grown and to the underdraining of the lower lying areas of the type. The abundance of weeds contained in the hay harvested from this land shows that the sod is allowed to stand too long without reseeding. The best results seem to be obtained where the land is reseeded after two years have been devoted to hay production.

In the higher lying areas the soil may be improved by the methods suggested for the Holston silt loam.

POPE SANDY LOAM.

The surface soil of the Pope sandy loam is a light-brown, coarse to medium textured, mellow sandy loam, about 6 to 10 inches deep. The subsoil is a yellowish-brown, medium-textured, slightly compact and friable sandy loam or loam. Occasionally fragments of sandstone and shale are encountered near the bottom of the 3-foot section.

The type occurs as overflowed areas along streams whose drainage basins are composed largely of areas of the Dekalb stony silt loam and Rough stony land. This type as mapped is not extensive, being encountered only in the extreme southeastern part of Lewis County, but its development here adjoins extensive areas of similar character in bordering counties.

The topography usually is level, but is varied by occasional swells. The drainage is well established, owing to the porous nature of the surface soil and the substratum of more or less gravelly material. The type lies only 3 to 10 feet above stream level and is subject to occasional overflows.

The original forest growth on the Pope sandy loam consisted of sycamore, beech, birch, and willow. Most of the land is cleared and under cultivation. Corn occupies probably three-fourths of the cultivated area. Yields range from 25 to 45 bushels per acre. Little attempt is made to use the land for hay or permanent pasture, as the soil is not suited to grass. Sorghum, cowpeas, millet, Irish potatoes, sweet potatoes, and various other vegetables are grown successfully. Sorghum, cowpeas, and millet, however, are grown only in small patches, and potatoes and other vegetables are confined to gardens. Little live stock is kept on this soil.

Agriculture on the Pope sandy loam is not highly developed. No fertilizers are used and no organic matter is turned under, the deposits of alluvium from overflows being depended upon to keep up the productiveness of the type. The soil is easily cultivated; but little improved farm machinery is used.

Land of this type of soil is valued at about \$20 to \$40 an acre.

This soil, although alluvial and enriched by stream sediment, is deficient in organic matter, and some crops, such as rye, vetch or cowpeas, should be turned under to remedy this deficiency. The application of a complete fertilizer preparation at the rate of about 300 to 600 pounds per acre apparently would be beneficial with nearly all crops. Much more attention could well be given to the selection of the variety of corn to be grown, as this is the main crop. This soil is well suited to sorghum, sweet potatoes, melons, and light truck crops, and trucking could be developed into a profitable adjunct to general farming where economic conditions are favorable.

POPE SILT LOAM.

The surface soil of the Pope silt loam is a brown or grayish-brown, medium-heavy, mellow silt loam, which grades at about 8 to 10 inches into a subsoil consisting of light yellowish brown, heavy silt loam, friable, and slightly compact in the lower part.

The type is developed as first-bottom land along streams draining uplands where the Dekalb silt loam is the predominant type. It occurs in narrow strips along small streams in the southern part of Lewis County. The type is subject to frequent overflows, lying only 2 to 5 feet above normal stream level, and in places drainage is poorly established.

This type is inextensive, but most of the land is cleared and is either planted to corn or used for hay or pasturage. Much of the type is low lying and is devoted to permanent pasture. Corn occupies about 20 per cent of the total area. About the same number of beef cattle are kept upon this type as upon the Moshannon silt loam.

Corn yields from 30 to 60 bushels and timothy hay about 1 to $1\frac{1}{2}$ tons per acre. No crop rotations are followed, the same field being used indefinitely for one crop. No fertilizer, lime or manure is applied.

The Pope silt loam can be improved in the same way as the Moshannon silt loam. Underdrainage, however, is more essential; there are considerable areas that would be materially improved by tile drainage. The Pope silt loam is a strong, productive soil where well drained and properly handled. Corn and hay are the crops best suited to this soil.

ROUGH STONY LAND.

Rough stony land in this area consists of steep land so covered with stone or containing so much protruding bedrock as to make cultivation impossible. Only a small total area of Rough stony land is mapped. The type usually occupies steep bluffs or steep valley walls in the bends of streams. Most of this land is in forest, the growth consisting of white, red, and chestnut oak, poplar, chestnut, white pine, hemlock, and mountain laurel. It can be grazed to a certain extent or used for forestry; otherwise it is of little agricultural value.

SUMMARY.

Lewis and Gilmer Counties are situated in the central part of West Virginia, and comprise a total area of 733 square miles, or 469,120 acres.

The topography in general is steep and broken. Lewis County is slightly higher in general elevation and less deeply dissected than Gilmer County. The elevation ranges from 700 feet to 1,500 feet above sea level in Gilmer County and from 1,000 to 1,800 feet in Lewis County.

Lewis County is drained by the West Fork River, and Gilmer County by the Little Kanawha River and its tributaries.

The two counties have a total population of 29,660. Lewis County, is the more densely populated of the two. Weston, in Lewis County, is the largest town. The greater part of the population of both counties is engaged in farming, although a large number of persons in Lewis County are interested in oil and natural gas and allied industries.

Lewis County is quite well supplied with railroads, but Gilmer County has poor transportation facilities. The public roads are fairly good, considering the character of the topography.

Weston and Clarksburg constitute good local markets for farm produce. Pittsburgh, Baltimore, and Philadelphia are the principal markets for live stock.

The climate of Gilmer and Lewis Counties is mild and healthful and is well suited to general farming and stock raising. The mean temperature for the winter is 32.4° F., and for the summer, 72.5 F. The mean annual precipitation of 46.85 inches is well distributed throughout the year. The active growing season averages five and one-half months.

The agriculture of Gilmer and Lewis Counties consists mainly of general farming and stock raising. The crops grown are principally corn, oats, and hay (timothy). There is a large acreage of permanent bluegrass pasture.

The farm dwellings are well cared for and substantial, the barns are fairly large, and there are a large number of silos in the area. The work stock consists of horses of heavy-draft types. The farm machinery is in general modern. With the development of the oil and gas resources farming was for a time neglected, but within the last few years more attention has been given agriculture.

No general system of crop rotation is practiced. Fertilizer and lime are used only in relatively small quantities. Efficient farm labor is scarce, owing to the higher wages paid in the oil and gas industries.

The farms in Gilmer County average 116.5 acres in size and in Lewis County 134 acres. More than 80 per cent of the farms are operated by owners. The majority of the tenants in Lewis County

rent for cash, but in Gilmer County farms are rented largely on a share basis.

The average value of all farm property in Gilmer County, according to the census of 1910, is \$2,996 per farm, and \$5,621 per farm in Lewis County. The average assessed value of land in 1910 is reported as \$17.03 an acre in Gilmer County and \$29.81 an acre in Lewis County.

Gilmer and Lewis Counties lie wholly within the Appalachian Mountains and Plateau Province. The upland soils are derived from the weathering in place of alternate strata of sandstone, gray and red shale, and thin beds of limestone of the Upper Coal Measures. Here the soil belongs to the Dekalb, Upshur, and Meigs series. The alluvial deposits along the streams are derived wholly from material washed from the residual soils of the region. The Holston series, on the terraces or second bottoms, and the Moshannon and Pope series, in the first bottoms, comprise the alluvial soils.

The Dekalb series is characterized by gray to yellowish-brown surface soils and yellowish-brown subsoils. The stony silt loam covers a small area and is not important. The silt loam is the most extensive soil type mapped in the area. It is well suited to pasture and in the more level areas to general-farming crops, such as corn, oats, and hay, as well as fruit.

The Upshur silty clay loam, the only soil of this series mapped, has an Indian-red or reddish-brown surface soil and subsoil. The type is widely distributed and is a durable upland soil. It is well suited to bluegrass, wheat, oats, corn, and hay.

The Meigs clay loam represents Upshur and Dekalb soils undifferentiated. Most of this type is in cut-over or pasture land.

The Holston silt loam, of the second bottoms, has a brownish surface soil and a yellowish-brown subsoil. It is not a strong soil, but responds readily to proper treatment. It has a smooth topography and is valuable for building sites and industrial developments.

The Moshannon silt loam is a reddish-brown soil. It is the strongest bottom-land type in the two counties, giving excellent yields of corn and hay without the use of fertilizers.

The Pope sandy loam and silt loam are first-bottom, overflow soils of a brownish color. They are encountered in only small areas, but are mostly cleared and used for agriculture.

Rough stony land is of little agricultural value. It comprises small areas of steep land covered with stone or containing numerous outercropping rock ledges.



[PUBLIC RESOLUTION—No. 9.]

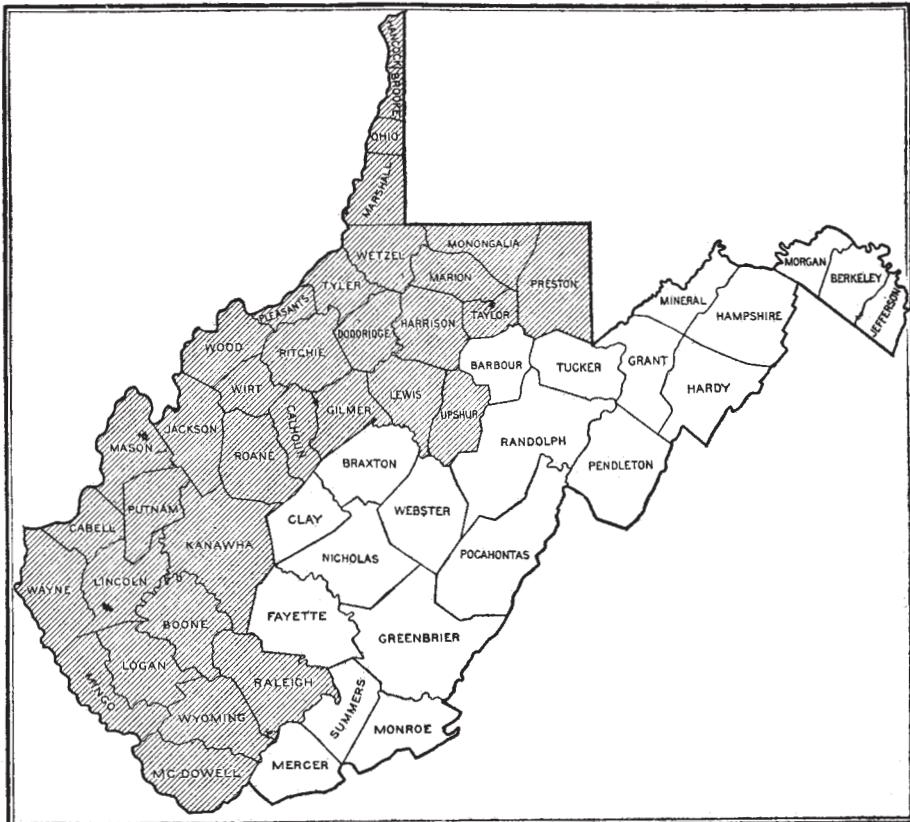
JOINT RESOLUTION Amending public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, "providing for the printing annually of the report on field operations of the Division of Soils, Department of Agriculture."

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That public resolution numbered eight, Fifty-sixth Congress, second session, approved February twenty-third, nineteen hundred and one, be amended by striking out all after the resolving clause and inserting in lieu thereof the following:

That there shall be printed ten thousand five hundred copies of the report on field operations of the Division of Soils, Department of Agriculture, of which one thousand five hundred copies shall be for the use of the Senate, three thousand copies for the use of the House of Representatives, and six thousand copies for the use of the Department of Agriculture: *Provided*, That in addition to the number of copies above provided for there shall be printed, as soon as the manuscript can be prepared, with the necessary maps and illustrations to accompany it, a report on each area surveyed, in the form of advance sheets, bound in paper covers, of which five hundred copies shall be for the use of each Senator from the State, two thousand copies for the use of each Representative for the congressional district or districts in which the survey is made, and one thousand copies for the use of the Department of Agriculture.

Approved, March 14, 1904.

[On July 1, 1901, the Division of Soils was reorganized as the Bureau of Soils.]



Areas surveyed in West Virginia.

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